

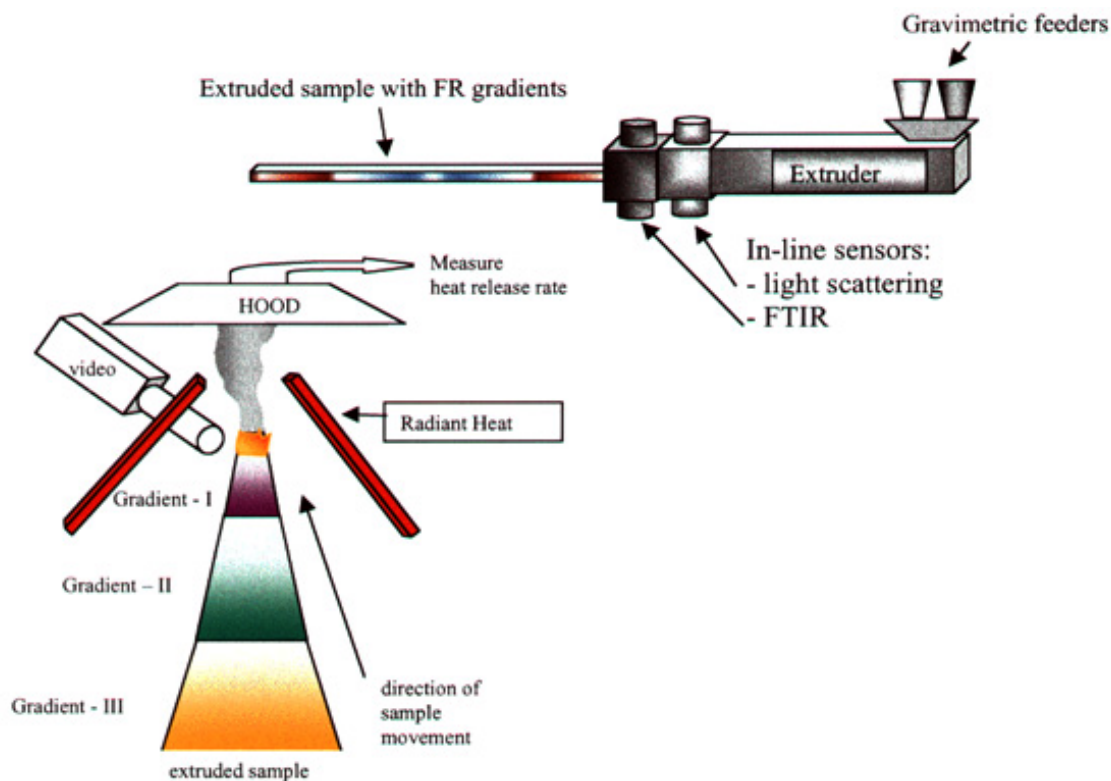
The construction of a prototype CFFTE and the subsequent validation of the high-throughput flammability test will require a multi-year research effort. The immediate objective is to provide a detailed proof of concept that will consist of independent demonstrations of the feasibility of each of the following component processes.

1. **The extrusion of multi-component samples with continuously varying compositions by computer-controlled gravimetric feeding.**

A computer-controlled gravimetric feeder will be installed on our extruder and tested by blending a polymer resin with a variety of inorganic additives. The limitations of computer-controlled mixing, with respect to the number of additives, the range of compositions, and reproducibility, will be assessed by comparing the results obtained from chemical gas analyses of the extruded material with the expected (programmed) sample compositions.

2. **Online analysis of the extruded material by fiber-optically coupled Fourier Transform Infrared (FTIR) spectrometry and continuous static light scattering.**

The signal-to-noise levels of mid-infrared (MIR) spectra of thin film samples produced on the extruder will be determined as a function of scan time. The accuracy of the on-line characterizations will be assessed by comparing results obtained from the quantitative analyses of MIR spectra, which will be acquired at times comparable to the output of the extruder, to the values obtained from the chemical analyses of representative samples of the extruded material. Similar studies will be conducted to determine the reliability of continuous static light scattering methods in assessing the dispersion of the additives in the extruded resin. In the application to polymer-clay nanocomposites described in the following section of this paper, we will also use x-ray diffraction (XRD) transmission electron microscopy (TEM) to verify the dispersion of the polymer and clay.



**3. Continuous flammability assessments by heat release rate (HRR) measurements on the extruded material.**

The optimal conditions for a continuous flow flammability test will be determined by performing HRR measurements on extruded material as a function of the mass and shape of the sample and comparing the results to those obtained from standard flammability tests which are routinely performed in this laboratory.

The second and third phases of this project, consisting of the construction of the prototype CFFTE and the development, validation and benchmarking of the flammability test method, will be undertaken as soon as we establish the long-range viability of the approach in phase 1.